



CERTIFICATE OF TRANSLATION

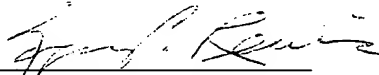
The undersigned, Roger P. Lewis, whose address is 3206 Lock Gate Ct., Herndon, VA 22071, declares and states the following:

I am well acquainted with the English and Japanese languages and have in the past translated into English numerous Japanese documents of legal and/or technical content.

I hereby certify that the English translation of Japanese Patent Reference 5-42230 is to the best of my knowledge and ability true and accurate.

I further declare that all statements contained herein of my own knowledge, are true, that all statements of information and belief are believed to be true, and that these and similar statements are punishable by fines or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

December 2, 1996

  
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Roger P. Lewis

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(54) Title of Invention: Fire-extinguishing agents

(57) Abstract

[Construction] Fire-extinguishing agents which contain at least one kind chosen from a group of (1) chain-form or branch-form saturated halogenated hydrocarbon with 1~4 carbon atoms replaced with fluorine and/or chlorine, (2) cyclic saturated halogenated hydrocarbon with 3~4 carbon atoms and replaced with fluorine, and (3) chain-form or branch-form unsaturated halogenated hydrocarbon with 3~4 carbon atoms and a double bond replaced with fluorine, and which also contain at least one kind of halogenated hydrocarbon where the number of hydrogen atoms or chlorine atoms is always smaller than the number of carbon atoms in (1), (2), and (3).

[Efficacy] It has become possible to provide safe fire-extinguishing agents which have similar extinguishing property to the conventional ones and yet do not destroy the ozone layer.

[Scope of Patent Claims]

[Claim 1] Fire-extinguishing agents which contain at least one kind chosen from a group of (1) chain-form or branch-form saturated halogenated hydrocarbon with 1~4 carbon atoms replaced with fluorine and/or chlorine, (2) cyclic saturated halogenated hydrocarbon with 3~4 carbon atoms and replaced with fluorine, and (3) chain-form or branch-form unsaturated halogenated hydrocarbon with 3~4 carbon atoms and a double bond replaced with fluorine, and which also contain at least one kind of halogenated hydrocarbon where the number of hydrogen atoms or chlorine atoms is always no larger than the number of carbon atoms, respectively, in (1), (2), and (3).

[Claim 2] Fire-extinguishing agents described in Claim 1 which contain at least one kind chosen from a group of (1a) chain-form or branch-form saturated fluorohydrocarbon with 1~4 carbon atoms and replaced with fluorine where the number of hydrogen atoms is always no larger than the number of carbon atoms, (2a) cyclic saturated fluorohydrocarbon with 3~4 carbon atoms and replaced with fluorine where the number of hydrogen atoms is always smaller than the number of carbon atoms, and (3a) chain-form or branch-form unsaturated fluorohydrocarbon with 3~4 carbon atoms and a double bond replaced with fluorine where the number of hydrogen atoms is always smaller than the number of carbon atoms.

[Claim 3] Fire-extinguishing agents described in Claim 1 which contain at least one kind chosen from a group of (1b) chain-form or branch-form saturated carbon fluoride with 1~4 carbon atoms, (2b) cyclic saturated carbon fluoride with 3~4 carbon atoms, and (3b) chain-form or branch-form unsaturated carbon fluoride with 3~4 carbon atoms and a double bond.

[Claim 4] Fire-extinguishing agents described in Claim 1 which contain (1c) chain-form or branch-form saturated fluorochlorohydrocarbon with 1~3 carbon atoms and replaced with fluorine and chlorine where the number of hydrogen or chlorine atoms is always no larger than the number of carbon atoms, respectively.

[Claim 5] Fire-extinguishing agents described in Claim 1 which contain at least two kinds from a group consisting of fluorohydrocarbon described by (1a), (2a), and (3a), carbon fluoride described by (1b), (2b), and (3b), and fluorochlorohydrocarbon described by (1c).

[Claim 6] Fire-extinguishing agents described in Claim 5 where fluorohydrocarbon described by (1a), (2a), and (3a) is at least one kind from

CHF<sub>3</sub> : trifluoroethane,  
CHF<sub>2</sub>CHF<sub>2</sub> : 1,1,2,2-tetrafluoroethane,  
CH<sub>2</sub>FCF<sub>3</sub> : 1,1,1,2-tetrafluoroethane,  
CHF<sub>2</sub>CF<sub>3</sub> : pentafluoroethane,  
CHF<sub>2</sub>CHFCF<sub>3</sub> : 1,1,1,2,3,3-hexafluoropropane,  
CF<sub>3</sub>CHFCF<sub>3</sub> : 1,1,1,2,3,3,3-heptafluoropropane,  
CHF<sub>2</sub>CF<sub>2</sub>CF<sub>3</sub> : 1,1,1,2,2,3,3-heptafluoropropane,  
CH<sub>2</sub>=C(CF<sub>3</sub>)<sub>2</sub> : hexafluoroisobutane,  
C<sub>3</sub>H<sub>2</sub>F<sub>4</sub> : tetrafluorocyclopropane,  
C<sub>3</sub>HF<sub>5</sub> : pentafluorocyclopropane,  
C<sub>4</sub>H<sub>3</sub>F<sub>5</sub> : pentafluorocyclobutane,  
C<sub>4</sub>H<sub>2</sub>F<sub>6</sub> : hexafluorocyclobutane, and  
C<sub>4</sub>HF<sub>7</sub> : heptafluorocyclobutane,

carbon fluoride described by (1b), (2b), and (3b) is at least one kind from

CF<sub>4</sub> : tetrafluoromethane,  
C<sub>2</sub>F<sub>6</sub> : hexafluoroethane,  
C<sub>3</sub>F<sub>8</sub> : octafluoropropane,  
C<sub>4</sub>F<sub>8</sub> : octafluorocyclobutane, and  
C<sub>3</sub>F<sub>6</sub> : hexafluoropropene,

and fluorochlorohydrocarbon described by (1c) is at least one kind from

CHClF<sub>2</sub> : chlorodifluoromethane,  
CHCl<sub>2</sub>CF<sub>3</sub> : 1,1-dichloro-2,2,2-trifluoroethane,  
CHClFCClF<sub>2</sub> : 1,2-dichloro-1,1,2-trifluoroethane,  
CHF<sub>2</sub>CCl<sub>2</sub>F : 1,1-dichloro-1,2,2-trifluoroethane,  
CHClFCF<sub>3</sub> : 1-chloro-1,2,2,2-tetrafluoroethane, and  
CHF<sub>2</sub>CClF<sub>2</sub> : 1-chloro-1,1,2,2-tetrafluoroethane.

[Claim 7] Fire-extinguishing agents described in Claim 6 where fluorohydrocarbon described by (1a), (2a), and (3a) is at least one kind from

CHF<sub>3</sub> : trifluoromethane,  
CHF<sub>2</sub>CF<sub>3</sub> : pentafluoroethane,  
CF<sub>3</sub>CHFCF<sub>3</sub> : 1,1,1,2,3,3,3-heptafluoropropane, and  
CHF<sub>2</sub>CF<sub>2</sub>CF<sub>3</sub> : 1,1,1,2,2,3,3-heptafluoropropane,

carbon fluoride described by (1b), (2b), and (3b) is at least one kind from

CF<sub>4</sub> : tetrafluoromethane,  
C<sub>3</sub>F<sub>8</sub> : octafluoropropane, and  
C<sub>4</sub>F<sub>8</sub> : octafluorocyclobutane,

and fluorochlorohydrocarbon described by (1c) is at least one kind from

CHClF<sub>2</sub> : chlorodifluoromethane,  
CHCl<sub>2</sub>CF<sub>3</sub> : 1,1-dichloro-2,2,2-trifluoroethane,  
CHClFCF<sub>3</sub> : 1-chloro-1,2,2,2-tetrafluoroethane, and  
CHF<sub>2</sub>CClF<sub>2</sub> : 1-chloro-1,1,2,2-tetrafluoroethane.

[Claim 8] Fire-extinguishing agents described in Claim 6 each of which is one kind from a group consisting of

- (a) CHF<sub>3</sub>: trifluoromethane and CHF<sub>2</sub>CF<sub>3</sub>: pentafluoroethane,
- (b) CHF<sub>3</sub>: trifluoromethane and CF<sub>3</sub>CHF<sub>2</sub>CF<sub>3</sub>: 1,1,1,2,3,3,3-heptafluoropropane,
- (c) CHF<sub>2</sub>CF<sub>3</sub>: pentafluoroethane and CHF<sub>2</sub>CF<sub>2</sub>CF<sub>3</sub>: 1,1,1,2,2,3,3-heptafluoropropane,
- (d) CF<sub>3</sub>CHF<sub>2</sub>CF<sub>3</sub>: 1,1,1,2,3,3,3-heptafluoropropane and CHF<sub>2</sub>CF<sub>2</sub>CF<sub>3</sub>: 1,1,1,2,2,3,3-heptafluoropropane,
- (e) CHF<sub>2</sub>CF<sub>3</sub>: pentafluoroethane and CF<sub>3</sub>CHF<sub>2</sub>CF<sub>3</sub>: 1,1,1,2,3,3,3-heptafluoropropane,
- (f) CHF<sub>3</sub>: trifluoromethane and CHF<sub>2</sub>CF<sub>2</sub>CF<sub>3</sub>: 1,1,1,2,2,3,3-heptafluoropropane,
- (g) CF<sub>4</sub>: tetrafluoromethane and C<sub>4</sub>F<sub>8</sub>: octafluorocyclobutane,
- (h) CHClF<sub>2</sub>: chlorodifluoromethane and CHClF<sub>2</sub>CF<sub>3</sub>: 1-chloro-1,2,2,2-tetrafluoroethane,
- (i) CHClF<sub>2</sub>: chlorodifluoromethane and CHCl<sub>2</sub>CF<sub>3</sub>: 1,1-dichloro-2,2,2-trifluoroethane,
- (j) CF<sub>3</sub>CHF<sub>2</sub>CF<sub>3</sub>: 1,1,1,2,3,3,3-heptafluoropropane and CF<sub>4</sub>: tetrafluoromethane,
- (k) CHF<sub>3</sub>: trifluoromethane and C<sub>4</sub>F<sub>8</sub>: octafluorocyclobutane,
- (l) CF<sub>3</sub>CHF<sub>2</sub>CF<sub>3</sub>: 1,1,1,2,3,3,3-heptafluoropropane and CHClF<sub>2</sub>: chlorodifluoromethane,
- (m) CHF<sub>2</sub>CF<sub>3</sub>: pentafluoroethane and CHCl<sub>2</sub>CF<sub>3</sub>: 1,1-dichloro-2,2,2-trifluoroethane,
- (n) CF<sub>4</sub>: tetrafluoromethane and CHCl<sub>2</sub>CF<sub>3</sub>: 1,1-dichloro-2,2,2-trifluoroethane, and
- (o) C<sub>3</sub>F<sub>8</sub>: octafluoropropane and CHClF<sub>2</sub>CF<sub>3</sub>: 1-chloro-1,2,2,2-tetrafluoroethane.

[Detailed Description of the Invention]

[0001]

[Field of Industrial Applications] This invention belongs to fire-extinguishing agent.

[0002]

[Prior Art Technology and Its Problem] Conventionally, halogenated hydrocarbon was used as fire-extinguishing agent, especially bromine-atom-containing fire-extinguishing agent which has great extinguishing effect and is stable at high temperatures was generally used.

[0003] However, it is pointed out that bromine-atom-containing fire-extinguishing agent especially has a high ozone destruction coefficient (abbreviated as ODP below) and effectively destroys the ozone layer when released into the atmosphere, and that it can give serious bad influence to the ecosystem on earth including human being as the result.

[0004] Therefore, it is an urgent task to develop new fire-extinguishing agent which can replace conventional bromine-atom-containing fire-extinguishing agent and does not destroy the ozone layer.

[0005]

[Problems to be Overcome by the Invention] The objective of this invention is to provide fire-extinguishing agents which have great fire-extinguishing effect and no effect on the ozone layer even when they are released into the atmosphere.

[0006]

[Problem Resolution Means] This inventor, as the result of earnest investigation to achieve the said objective, completed this invention by discovering that compounds of single or mixture of specific halogenated hydrocarbons have excellent property as fire-extinguishing agent.

[0007] Namely, this invention provides fire-extinguishing agents which contain at least one kind chosen from a group of (1) chain-form or branch-form saturated halogenated hydrocarbon with 1~4 carbon atoms replaced with fluorine and/or chlorine, (2) cyclic saturated halogenated hydrocarbon with 3~4 carbon atoms and replaced with fluorine, and (3) chain-form or branch-form unsaturated halogenated hydrocarbon with 3~4 carbon atoms and a double bond replaced with fluorine, and which also contain at least one kind of halogenated hydrocarbon where the number of hydrogen atoms or chlorine atoms is always no larger than the number of carbon atoms, respectively, in (1), (2), and (3).

[0008] Also, this invention provides fire-extinguishing agents which contain at least one kind chosen from a group of (1a) chain-form or branch-form saturated fluorohydrocarbon with 1~4 carbon atoms and replaced with fluorine where the number of hydrogen atoms is always no larger than the number of carbon atoms, (2a) cyclic saturated fluorohydrocarbon with 3~4 carbon atoms and replaced with fluorine where the number of hydrogen atoms is always smaller than the number of carbon atoms, and (3a) chain-form or branch-form unsaturated fluorohydrocarbon with 3~4 carbon atoms and a double bond replaced with fluorine where the number of hydrogen atoms is always smaller than the number of carbon atoms.

[0009] Furthermore, this invention provides fire-extinguishing agents which contain at least one kind chosen from a group of (1b) chain-form or branch-form saturated carbon fluoride with 1~4 carbon atoms, (2b) cyclic saturated carbon fluoride with 3~4 carbon atoms, and (3b) chain-form or branch-form unsaturated carbon fluoride with 3~4 carbon atoms and a double bond.

[0010] Furthermore, this invention provides fire-extinguishing agents which contain (1c) chain-form or branch-form saturated fluorochlorohydrocarbon with 1~3 carbon atoms and replaced with fluorine and chlorine where the number of hydrogen or chlorine atoms is always no larger than the number of carbon atoms, respectively.

[0011] Furthermore, this invention provides fire-extinguishing agents which contain at least two kinds from a group consisting of fluorohydrocarbon described by (1a), (2a), and (3a), carbon fluoride described by (1b), (2b), and (3b), and fluorochlorohydrocarbon described by (1c).

[0012] As fluorohydrocarbon described by (1a), (2a), and (3a), for example, listed are

- (1)  $\text{CHF}_3$  : trifluoroethane (HFC23, code names are shown in parentheses below),
- (2)  $\text{CHF}_2\text{CHF}_2$  : 1,1,2,2-tetrafluoroethane (HFC134),
- (3)  $\text{CH}_2\text{FCF}_3$  : 1,1,1,2-tetrafluoroethane (HFC134a),
- (4)  $\text{CHF}_2\text{CF}_3$  : pentafluoroethane (HFC125),
- (5)  $\text{CHF}_2\text{CHFCF}_3$  : 1,1,1,2,3,3-hexafluoropropane (HFC236ea),
- (6)  $\text{CF}_3\text{CHFCF}_3$  : 1,1,1,2,3,3,3-heptafluoropropane (HFC227ea),
- (7)  $\text{CHF}_2\text{CF}_2\text{CF}_3$  : 1,1,1,2,2,3,3-heptafluoropropane (HFC227ca),
- (8)  $\text{CH}_2=\text{C}(\text{CF}_3)_2$  : hexafluoroisobutane (HFC1336),

- (9)  $C_3H_2F_4$  : tetrafluorocyclopropane (C-234),
- (10)  $C_3HF_5$  : pentafluorocyclopropane (C-225),
- (11)  $C_4H_3F_5$  : pentafluorocyclobutane (C-345),
- (12)  $C_4H_2F_6$  : hexafluorocyclobutane (C-336),
- (13)  $C_4HF_7$  : heptafluorocyclobutane (C-327), etc.

[0013] As carbon fluoride described by (1b), (2b), and (3b), for example, listed are

- (14)  $CF_4$  : tetrafluoromethane (FC14),
- (15)  $C_2F_6$  : hexafluoroethane (FC116),
- (16)  $C_3F_8$  : octafluoropropane (FC218),
- (17)  $C_4F_{10}$  : octafluorocyclobutane (FC-C318),
- (18)  $C_3F_6$  : hexafluoropropene (FC216), etc.

[0014] As fluorochlorohydrocarbon described by (1c), for example, listed are

- (19)  $CHClF_2$  : chlorodifluoromethane (HCFC22),
- (20)  $CHCl_2CF_3$  : 1,1-dichloro-2,2,2-trifluoroethane (HCFC123),
- (21)  $CHClFCClF_2$  : 1,2-dichloro-1,1,2-trifluoroethane (HCFC123a),
- (22)  $CHF_2CCl_2F$  : 1,1-dichloro-1,2,2-trifluoroethane (HCFC123b),
- (23)  $CHClFCCF_3$  : 1-chloro-1,2,2,2-tetrafluoroethane (HCFC124),
- (24)  $CHF_2CClF_2$  : 1-chloro-1,1,2,2-tetrafluoroethane (HCFC124a), etc.

[0015] Fire-extinguishing agents which contain at least two kinds from a group consisting of fluorohydrocarbon described by (1a), (2a), and (3a), carbon fluoride described by (1b), (2b), and (3b), and fluorochlorohydrocarbon described by (1c) may contain more than two kinds chosen from each single group described by (1a), (2a), and (3a); (1b), (2b), and (3b); or (1c).

[0016] When mixing compounds described by (1a), (2a), and (3a), compounds described by (1b), (2b), and (3b), or compounds described by (1c), although their mixing ratios are arbitrary, the preferable mixing composition is determined by considering vapor pressure, jet property, boiling point, etc.

[0017] When fire-extinguishing agents of this invention consist of two kinds of halogenated hydrocarbons, the preferable combinations are as follows.

[0018] Namely, when containing two kinds of compounds described by (1a), (2a), and (3a), the preferable combinations are

- (a)  $CHF_3$ : trifluoromethane and  $CHF_2CF_3$ : pentafluoroethane,
- (b)  $CHF_3$ : trifluoromethane and  $CF_3CHFCF_3$ : 1,1,1,2,3,3,3-heptafluoropropane,
- (c)  $CHF_2CF_3$ : pentafluoroethane and  $CHF_2CF_2CF_3$ : 1,1,1,2,2,3,3-heptafluoropropane,
- (d)  $CF_3CHFCF_3$ : 1,1,1,2,3,3,3-heptafluoropropane and  $CHF_2CF_2CF_3$ : 1,1,1,2,2,3,3-heptafluoropropane,
- (e)  $CHF_2CF_3$ : pentafluoroethane and  $CF_3CHFCF_3$ : 1,1,1,2,3,3,3-heptafluoropropane, and
- (f)  $CHF_3$ : trifluoromethane and  $CHF_2CF_2CF_3$ : 1,1,1,2,2,3,3-heptafluoropropane.

[0019] When containing two kinds of compounds described by (1b), (2b), and (3b), the preferable combination is

(g)  $\text{CF}_4$ : tetrafluoromethane and  $\text{C}_4\text{F}_8$ : octafluorocyclobutane.

[0020] When containing two kinds of compounds described by (1c), the preferable combination is

(h)  $\text{CHClF}_2$ : chlorodifluoromethane and  $\text{CHClFCF}_3$ : 1-chloro-1,2,2,2-tetrafluoroethane, and

(i)  $\text{CHClF}_2$ : chlorodifluoromethane and  $\text{CHCl}_2\text{CF}_3$ : 1,1-dichloro-2,2,2-trifluoroethane.

[0021] When containing one kind each from compounds described by (1a), (2a), and (3a), and from compounds described by (1b), (2b), and (3b), the preferable combinations are

(j)  $\text{CF}_3\text{CHFCF}_3$ : 1,1,1,2,3,3,3-heptafluoropropane and  $\text{CF}_4$ : tetrafluoromethane, and

(k)  $\text{CHF}_3$ : trifluoromethane and  $\text{C}_4\text{F}_8$ : octafluorocyclobutane.

[0022] When containing one kind each from compounds described by (1a), (2a), and (3a), and from compounds described by (1c), the preferable combinations are

(l)  $\text{CF}_3\text{CHFCF}_3$ : 1,1,1,2,3,3,3-heptafluoropropane and  $\text{CHClF}_2$ : chlorodifluoromethane, and

(m)  $\text{CHF}_2\text{CF}_3$ : pentafluoroethane and  $\text{CHCl}_2\text{CF}_3$ : 1,1-dichloro-2,2,2-trifluoroethane.

[0023] When containing one kind each from compounds described by (1b), (2b), and (3b), and from compounds described by (1c), the preferable combinations are

(n)  $\text{CF}_4$ : tetrafluoromethane and  $\text{CHCl}_2\text{CF}_3$ : 1,1-dichloro-2,2,2-trifluoroethane, and

(o)  $\text{C}_3\text{F}_8$ : octafluoropropane and  $\text{CHClFCF}_3$ : 1-chloro-1,2,2,2-tetrafluoroethane.

[0024] Mixing ratio in fire-extinguishing agents of these 15 kinds of preferable combinations is preferably one compound 95~5 mol% and the other compound 5~95 mol%.

[0025] Fire-extinguishing agents of this invention can contain, for example, one or more kinds of gaseous jet agents to promote release of fire-extinguishing agent from a fire extinguisher. As such jet agent, nitrogen and carbon dioxide can be listed for example.

[0026]

[Efficacy of the Invention] Fire-extinguishing agents of this invention have similar fire-extinguishing performance to the conventional ones and small ozone destruction coefficients, thus safe fire-extinguishing agents without any bad influence to the Earth environment can be provided.

[0027]

[Embodiment] Below, embodiments and comparison examples are shown to clarify further the characteristics of this invention.

[0028]

[Embodiment 1] In order to evaluate fire-extinguishing performance of the fire-extinguishing agents of this invention, concentrations of fire-extinguishing agents necessary to extinguish fire were measured for the fire-extinguishing agents of this invention and their comparison products



by the cup-burner method (refer to Fire-Extinguishing Research Center Report No. 57 (March 1984), page 4).

[0029] The measurements were performed by using n-heptane as fuel, supplying air at 15 l/min flow rate, and gradually adding fire-extinguishing agent, and concentration of the fire-extinguishing agent was measured when the fire is extinguished.

[0030] Measurement results of fire-extinguishing concentration are listed in Table 1 below.

[0031]

[Table 1]

	Category	Fire-Extinguishing Agents	Molecular Formula	Molecular Weight	Fire-Extinguishing Concentration (vol%)
Embodiments	HFC	HFC23	$\text{CHF}_3$	70	12.8
		HFC134	$\text{CHF}_2\text{CHF}_2$	102	11.3
		HFC134a	$\text{CH}_2\text{FCF}_3$	102	10.7
		HFC125	$\text{CHF}_2\text{CF}_3$	120	9.1
		HFC236ea	$\text{CHF}_2\text{CHFCF}_3$	152	7.7
		HFC1336	$\text{CH}_2=\text{C}(\text{CF}_3)_2$	140	6.7
		HFC227ea	$\text{CF}_3\text{CHFCF}_3$	170	6.8
		HFC227ca	$\text{CHF}_2\text{CF}_2\text{CF}_3$	170	6.6
	FC	FC14	$\text{CF}_4$	88	16.5
		FC116	$\text{CF}_3\text{CF}_3$	138	9.2
		FC216	$\text{CF}_2\text{CF}=\text{CF}_2$	150	7.9
		FC218	$\text{CF}_3\text{CF}_2\text{CF}_3$	188	6.7
		FC-C318	$\text{C}_4\text{F}_8$	200	7.0
	HCFC	HCFC22	$\text{CHClF}_2$	86	11.6
		HCFC124	$\text{CHClFCF}_3$	136	7.6
		HCFC123	$\text{CHCl}_2\text{CF}_3$	153	7.0
		HCFC123a	$\text{CHClFCClF}_2$	153	7.2
	Mixtures	HCFC124/ C318 (Mixing composition/ 66/34)		153	7.8
Comparison	Others	CO2	CO2	44	21.3

Examples	R502 (ECFC22/ CFC115)	HCFC22/115	112	9.6
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[0032] Note that as the comparison examples in the category of Table 1 measured were regulated Freon gas CFC115-containing R502 and carbon dioxide.

[0033] Also, the mixing ratio (HCFC124 : FC-C318 = 66 : 34) in the embodiments indicates the composition at the co-boiling point.

[0034] From the results in Table 1, it has turned out that the fire-extinguishing agents of this invention have excellent fire-extinguishing properties.

[0035]

[Embodiment 2] A fire-extinguishing test using one unit of the second model of the A fire was performed according to the national ordinance providing technical standards of fire extinguishers decided based on the regulations in Article 21-2, Section 2 of the Fire-Extinguishing Law.

[0036] For the said fire, released was single or mixed fire-extinguishing agent pressurized by 8 kg/cm<sup>2</sup> G nitrogen, and recorded were time until the fire was extinguished and amount of the needed fire-extinguishing agent as the released amount.

[0037] The test results are listed in Table 2.

[0038]

Table 2

Fire-Extinguishing Agents	Released Amount (g)	Fire-Extinction Time (seconds)
HFC23	1770	14.2
HFC134	1660	13.3
HFC134a	1620	12.9
HFC125	1490	11.9
HFC236ea	1370	11.0
HFiB	1280	10.2
HFC227ca	1290	10.3
FC14	2000	16.0
FC218	1280	10.2
FC-C318	1300	10.5
HFC23/125		
(25/75 mol%)	1530	12.2
(50/50 mol%)	1570	12.6
(75/25 mol%)	1690	13.5

HFC23/227ea		
(25/75 mol%)	1360	10.9
(50/50 mol%)	1430	11.4
(75/25 mol%)	1640	13.1
HFC125/227ea		
(25/75 mol%)	1300	10.4
(50/50 mol%)	1340	10.7
(75/25 mol%)	1400	11.2
HFC227ca	1260	10.2
HFC23/227ca		
(50/50 mol%)	1450	11.3
HFC125/227CA		
(50/50 mol%)	1340	10.6
HFC227ea/227ca		
(50/50 mol%)	1270	10.2

From the results in Table 2, it has been confirmed that the fire-extinguishing agents of this invention have excellent fire-extinguishing properties also for the said A fire.

[0039]

[Embodiment 3] The second fire-extinguishing test of the B fire was performed according to the ministerial ordinance providing technical standards of fire extinguishers decided based on the regulations in Article 21-2, Section 2 of the Fire-Extinguishing Law.

[0040] For a B fire with 0.2 m<sup>2</sup> burning surface area, released was single or mixed fire-extinguishing agent pressurized by 8 kg/cm<sup>2</sup> G nitrogen, and recorded were time until the fire was extinguished and amount of the needed fire-extinguishing agent as the released amount.

[0041] The test results are listed in Table 3.

[0042]

Table 3

Fire-Extinguishing Agents	Released Amount (g)	Fire-Extinction Time (seconds)
HFC23	440	3.5
HFC134	420	3.4
HFC134a	400	3.3
HFC125	370	3.0
HFC236ea	340	2.7
HF1B	320	2.6
HFC227ca	320	2.6
FC14	500	4.0
FC218	320	2.6
FC-C318	330	2.7

HFC23/125		
(25/75 mol%)	380	3.0
(50/50 mol%)	390	3.1
(75/25 mol%)	410	3.3
HFC23/227ea		
(25/75 mol%)	340	2.7
(50/50 mol%)	360	3.0
(75/25 mol%)	400	3.3
HFC125/227ea		
(25/75 mol%)	320	2.6
(50/50 mol%)	330	2.7
(75/25 mol%)	350	2.8
HFC227ca	320	2.6
HFC23/227ca		
(50/50 mol%)	330	3.0
HFC125/227CA		
(50/50 mol%)	340	2.8
HFC227ea/227ca		
(50/50 mol%)	330	2.6
FC14/FC-C318		
(50/50 mol%)	400	3.2
HCFC22/HCFC124		
(50/50 mol%)	330	3.0
HCFC22/HCFC123		
(50/50 mol%)	370	3.0
HFC227ea/FC14		
(50/50 mol%)	400	3.0
HFC23/FC-C318		
(50/50 mol%)	360	3.0
HFC227ea/HCFC22		
(50/50 mol%)	370	3.0
HFC125/HCFC123		
(50/50 mol%)	360	3.0
FC14/HCFC123		
(50/50 mol%)	400	3.2
FC218/HCFC124		
(50/50 mol%)	330	2.8

From the results in Table 3, it has been confirmed that the fire-extinguishing agents of this invention has excellent fire-extinguishing properties also for the said B fire.